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A Preliminary Map of the Wisconsin Till in Iowa

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moraine assumes massive proportions and extends across Kossuth county as a long, high hill several miles wide except where it has been cut by the Des Moines River, Four Mile creek and Lott's creek. Its outer margin passes near Irvington and Whittemore.

Northward the smaller and lower moraines of the substages are roughly parallel to the larger one and are somewhat irregularly distributed as described for Winnebago county. Examples are located just south of Lakota and another about two miles north of Titonka. Others near Burt, Fenton, and Swea City extend northwestward into Palo Alto and Emmett counties. Some of these are prominent just west of Armstrong and near the railroad southward from Ringsted, also in the area between Armstrong and Ringsted.

The principal moraine is much less prominent in Palo Alto and Emmett counties than elsewhere. This is partially due to erosion but chiefly due to the fact that as a deposit it was not so massively concentrated here. East of the Des Moines River but near it in Emmett county, the moraine is so high as to cause the drainage to flow away from the river along the depression partially occupied by High, Mud, and Swan lakes to be carried southward in Jack creek. Westward from the river and northward from Estherville the moraines are not distinctly separated from those of the Humboldt and Gary stages. In general the Algona stage correlates with an unnamed one mapped by Professor J. E. Todd in the Aberdeen-Redfield area in South Dakota (U.S.G.S. Folio No. 165).

IOWA STATE COLLEGE.

A PRELIMINARY MAP OF THE WISCONSIN TILL IN IOWA

JOHN E. SMITH

This map shows the positions of the margin, of the recessional stages and of the substages respectively of the Wisconsin ice sheet in Iowa where these positions have been determined. The outer boundary shown is taken chiefly from the maps of the Iowa Experiment Station and of the U.S. Soil Survey. The margin of the Altamont moraine is taken principally from the maps by the Iowa Geological Survey.

The Gary moraine as located on this map is chiefly the work of the writer but parts of it were either mapped or described some

years ago by Dr. S. W. Beyer, Dr. T. H. MacBride and others in the reports of the Iowa Geological Survey. As mapped at present it extends through a part of western Worth county, across a small part of southeastern Winnebago county, through eastern Hancock and Wright counties, along the boundary between Hamilton and Hardin counties, westward through Story and Boone counties, westward and northwestward through Greene county, northward through western Calhoun, Pocahontas and Palo Alto counties and into Emmet county.

This moraine exhibits about all of the variations described for major recessional features. It is high, rough and sandy or gravelly in some places and low and broad or nearly wanting in other localities. In its northern extremities in Iowa, it is not well segregated in some places from the other moraines near it. Other moraines mapped are described elsewhere in this volume.

THE HUMBOLDT STAGES OF THE WISCONSIN GLACIATION IN IOWA

JOHN E. SMITH

The Humboldt stages, like the Algona stages consist of a series of recessional moraines some of which are smaller than others, and some of which are poorly defined and irregular or missing in places. They are somewhat concentrically parallel to each other and are disposed at distances varying from two to eight miles apart along a main axial direction which extends southward near the east branch of the Des Moines river from southern Kossuth county to Humboldt, and along the Des Moines river south of Humboldt to Fort Dodge. Toward the places of union with the Gary moraine both eastward and westward the several moraines of this group converge to some extent.

The moraines of these stages are best developed a few miles west of Fort Dodge but are well defined along Lizard creek and its branches in Webster, Humboldt and Pocahontas counties. Most of them join the Gary moraine westward between Pocahontas and Emmetsburg. In some parts of southeastern Pocahontas county they are represented by a series of broad, low, gentle swells whose axes lie in a northwest-southwest direction. A part of one of these moraines extends eastward north of Rutland toward Hardy in Humboldt county, and another group extends from Medium Lake near Emmetsburg toward West Bend and eastward passing north of Livermore and just south of Luverne.